

Pagan River and Jones Creek TMDL Development

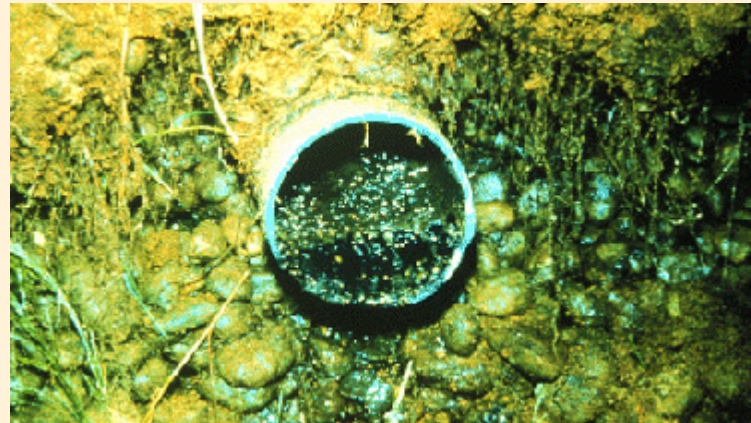
**Final Public Meeting
May 10, 2007**





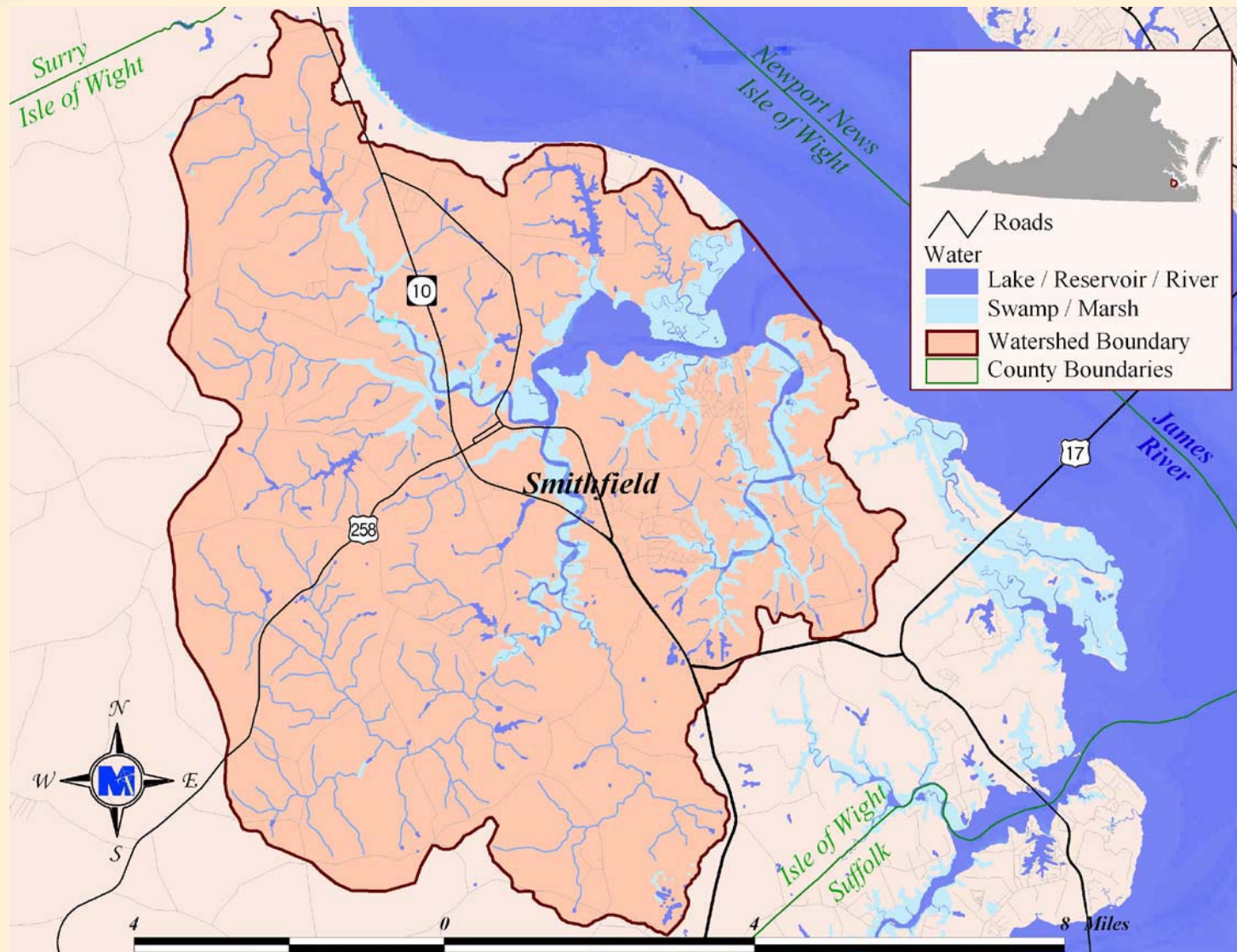
Why Are We Here?

- To discuss TMDLs for the Pagan River and Jones Creek
 - Total Maximum Daily Load
 - It is how much pollutant can enter the stream and have the stream meet the water quality standards





Where is the Watershed?

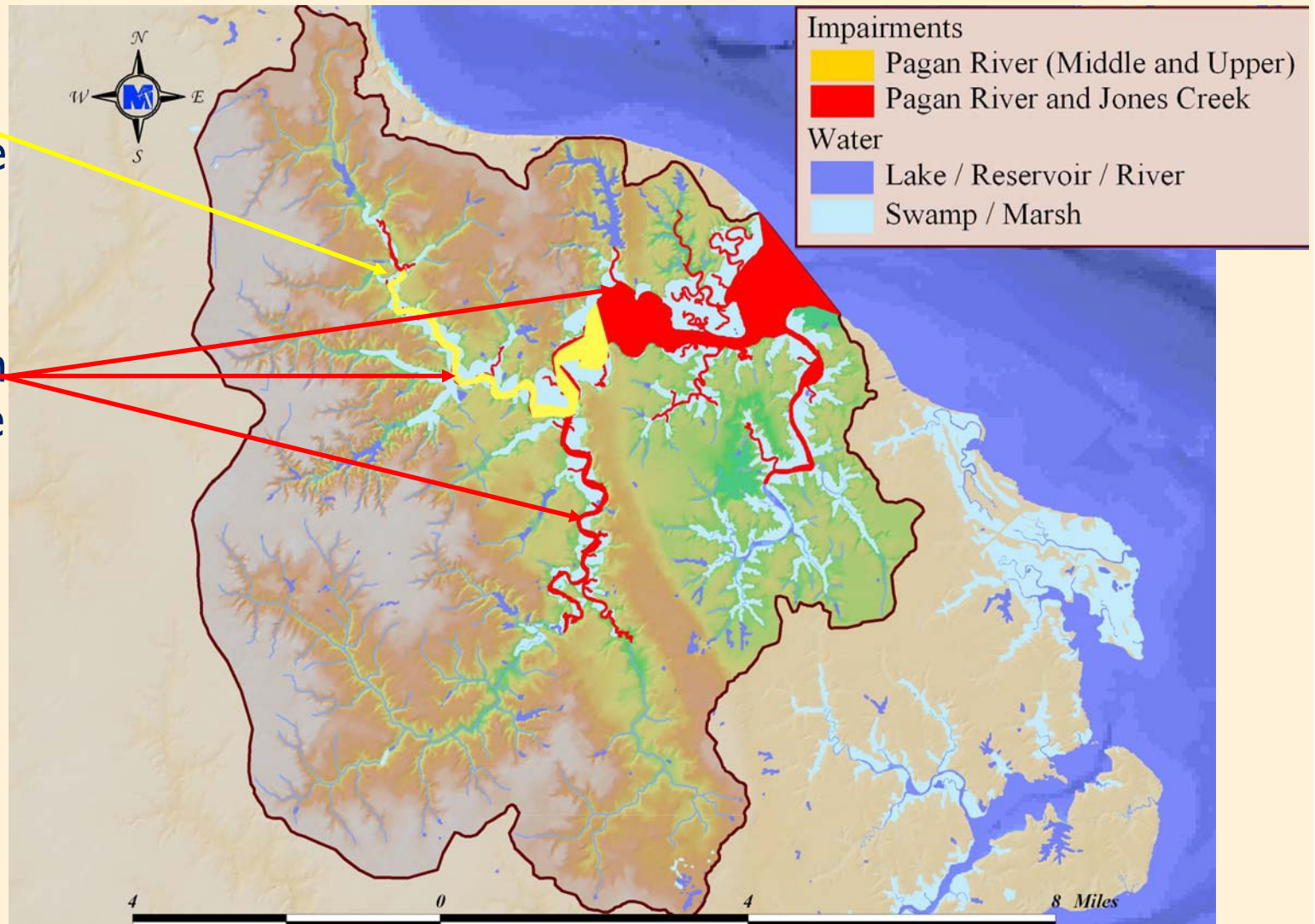


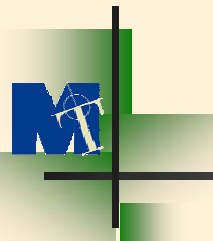


Where are the Impairments?

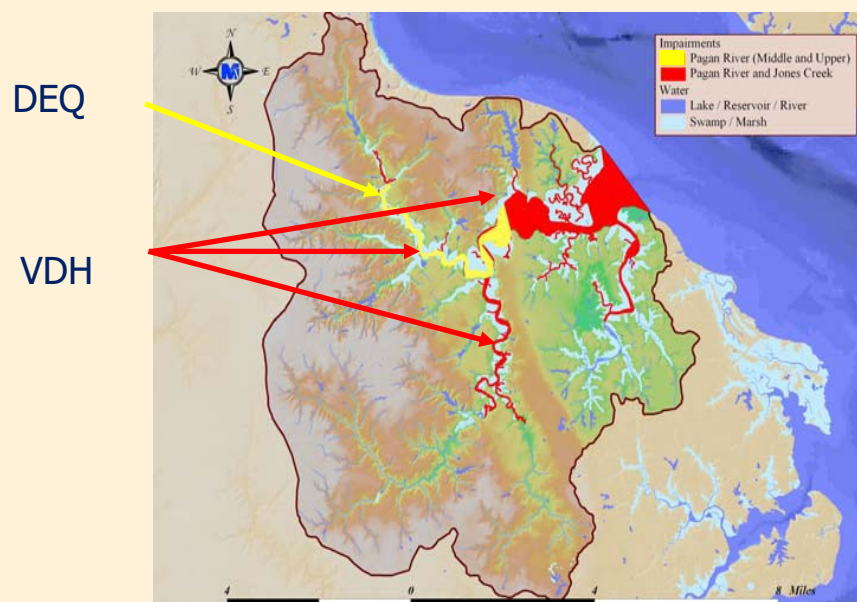
DEQ –
Swimming/
Recreation Use

VDH – Shellfish
Harvesting Use

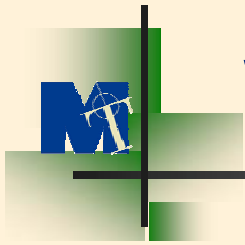




Where are the Impairments?



Impairment Name	Listed by	Reason Listed	Extent Description	Extent River Miles	Color in Figure
Pagan River (Middle and Upper)	DEQ	Excess fecal bacteria for swimming	End of tidal influence to downstream of Smithfield at Red Point	9.25 to 4.00	Yellow
Pagan River and Jones Creek	VDH	Excess fecal bacteria for harvesting shellfish	VDH-DSS Condemnation Area #061-064	9.5 to 0.0	Red



Water Quality Standards = Goals

- **DEQ Swimming/Recreation Use**

- *Enterococci* Bacteria Standards (for Estuarine)
 - ◆ 35 cfu/100mL calendar month geometric mean
 - ◆ 104 cfu/100mL instantaneous sample

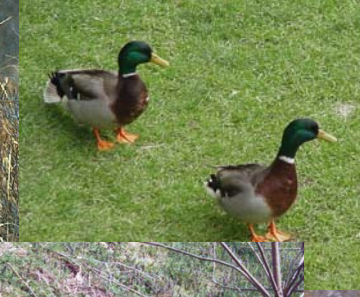
- **VDH Shellfish Harvesting Use**

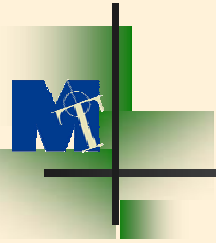
- Fecal Coliform Standards
 - ◆ 14 MPN 30-month geometric mean
 - ◆ 49 MPN 30-month 90th percentile

What are the Sources of Bacteria?



- Permitted Discharges
- Human
 - Failing Septics
 - Straight Pipes
 - Boats
- Pets
- Livestock
- Wildlife
- James River Tides

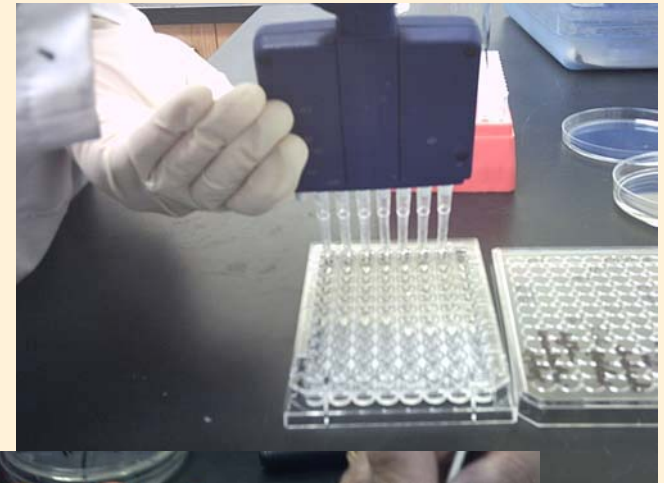




Bacterial Source Tracking (BST)

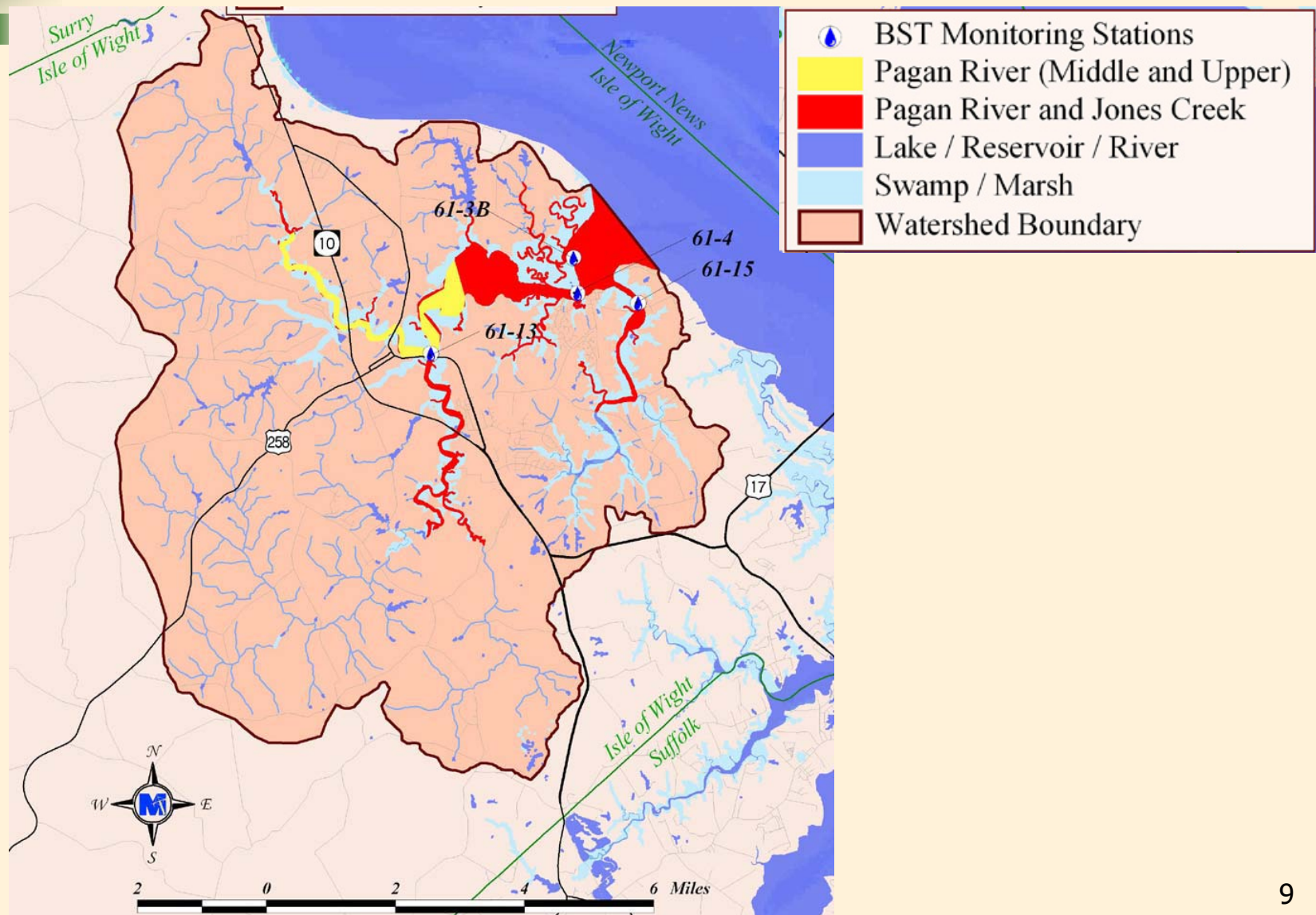
Independent Lab Test

- Determines bacteria source
 - Human
 - Pet
 - Livestock
 - Wildlife



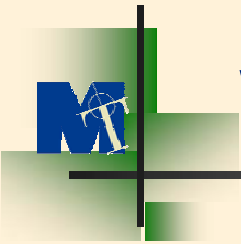


BST Monitoring



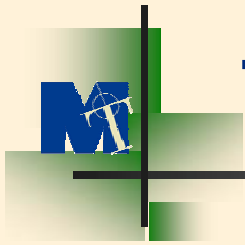
BST Results:

What is the Predominant Source?



Station	Stream	Wildlife	Weighted Averages:		
			Human	Livestock	Pet
61-13	Pagan River	35%	31%	17%	17%
61-4	Pagan River	17%	30%	19%	34%
61-15	Jones Creek	52%	13%	12%	23%
61-3B	Beatty Creek outlet	23%	13%	11%	53%





TMDL Development Steps

- Monitoring/Listing - Identify Water Quality Problem

- Monitoring Ongoing

- ✓ Listing Completed by DEQ and VDH

- Source Assessment – Locate Potential Sources of Pollutant in Watershed

- ✓ Estimates Presented at first public meeting

- ✓ ■ Modeling – Examine the Movement of Pollutant from Land to Water and Direct Inputs to Water

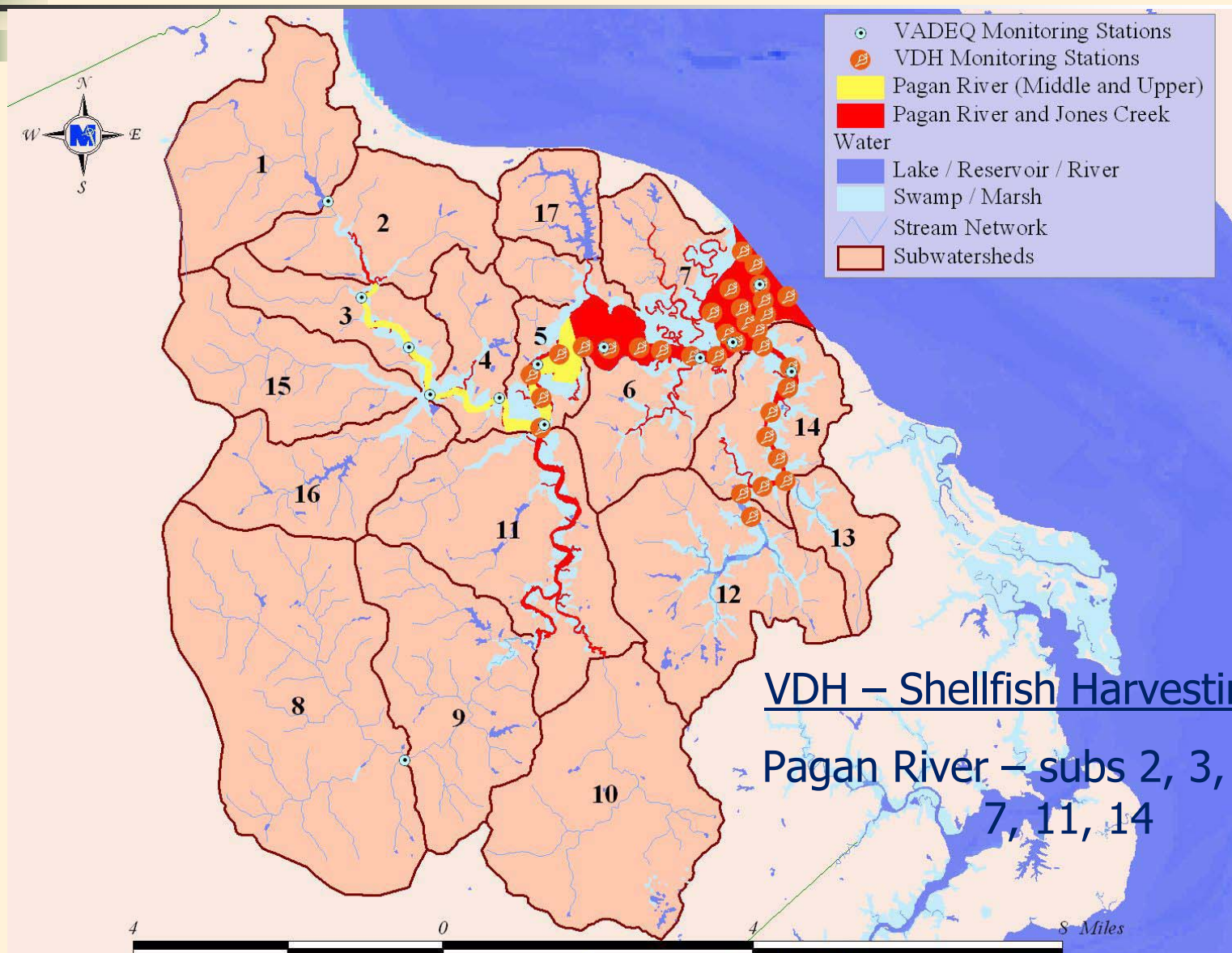
- ■ Allocation/TMDL – Use a Computer Model to Determine the Load Reductions Necessary to Achieve Water Quality Goals



Modeling

DEQ – Swimming/Recreation Use:

Pagan River (Middle and Upper) –
subs 3, 4, 5



VDH – Shellfish Harvesting Use:

Pagan River – subs 2, 3, 4, 5, 6,
7, 11, 14

How do we Determine the Bacteria TMDLs?



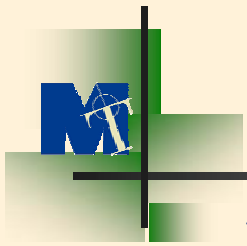
Bacteria
Sources

+

Watershed data



TMDL

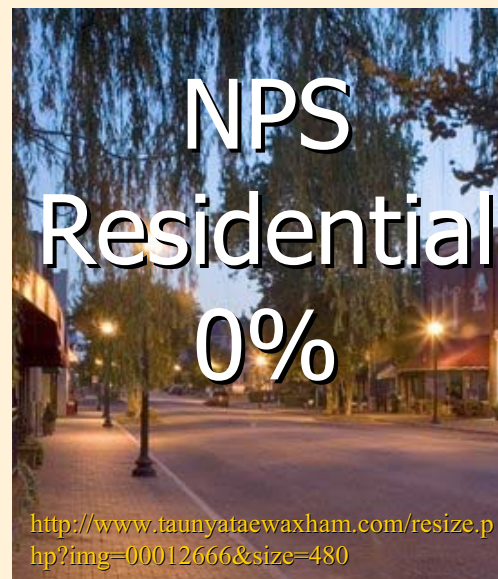


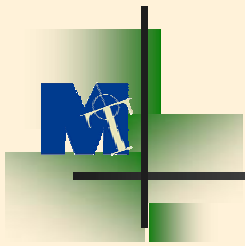
Pagan River (Middle and Upper): *Enterococci* % Reduction Scenarios *Swimming/Recreation Use*

Scenario	Reductions	% >35 Geometric Mean	% >104 Single Sample
1	None = Modeled Existing Conditions	100%	0%
2	100% correction of straight pipes	0%	0%

Final Allocation Scenario 2

What Reductions are required for Pagan River (Middle and Upper)?





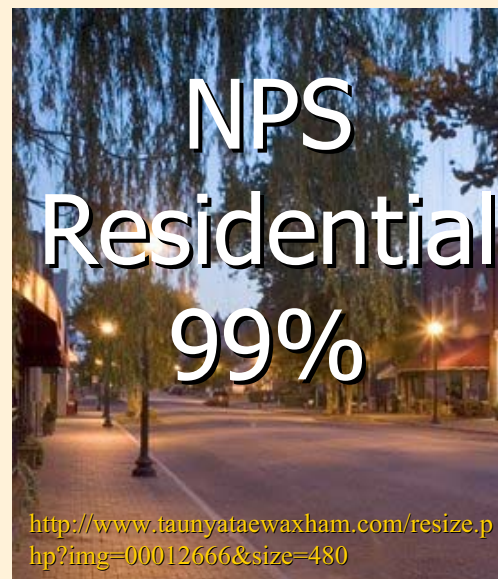
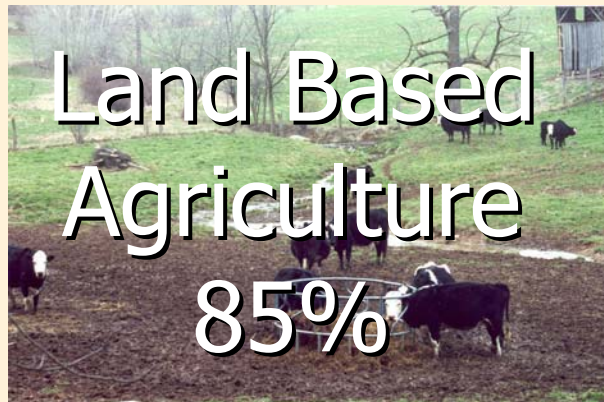
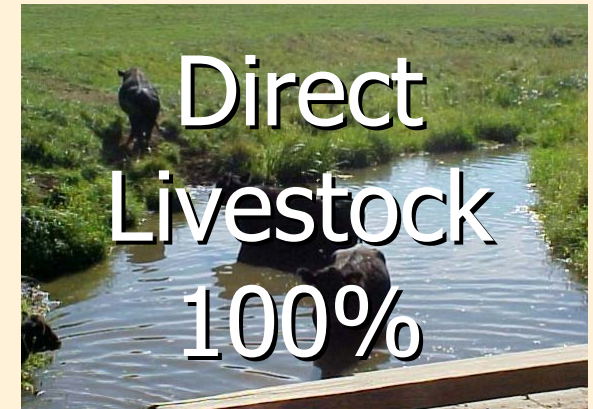
Pagan River and Jones Creek: Fecal Coliform % Reduction Scenarios *Shellfish Harvesting Use*

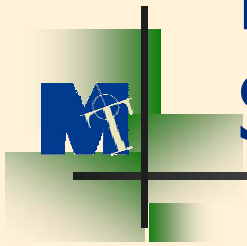
Scenario	Reductions	% >14 Geometric Mean	% >49 90th Percentile
1	None = Modeled Existing Conditions	100%	100%
2	100% correction of straight pipes	100%	100%
3	100% Anthropogenic (Human Influenced) Sources	100%	40%
4	100% correction of straight pipes, 100% Direct Livestock, 85% Agricultural Land, 99% Residential Land, 81% Wildlife Direct	0%	0%
5	100% correction of straight pipes, 100% Direct Livestock, 85% Agricultural Land, 99% Residential Land	100%	58%

Final Allocation Scenario 4
Stage I Management Scenario 5

Agricultural Land = Cropland, Pasture, Hay, Livestock Access to streams
Residential Land = Low density residential

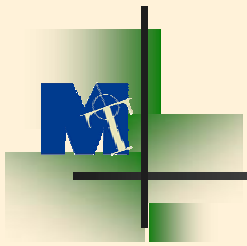
What Reductions are required for Pagan River and Jones Creek?





Municipal Separate Storm Sewer System (MS4)

- MS4 bacteria loads were estimated as sum of loads from impervious area within impairment drainage area
 - Residential, commercial/industrial/transportation land uses
- Isle of Wight (VAR040020)
 - Pagan River (Middle and Upper) total drainage area = 33,559 acres
 - 213 acres impervious
 - Pagan River and Jones Creek total drainage area = 46,420 acres
 - 360 acres impervious



Pagan River (Middle and Upper) *Enterococci* TMDL

Impairment	WLA	LA	MOS	TMDL
Pagan River (Middle and Upper)	3.01E+12	7.13E+13	<i>Implicit</i>	7.43E+13
<i>Isle of Wight MS4</i>	2.27E+12			
<i>VAR040020</i>				
<i>Future Load</i>	7.43E+11			

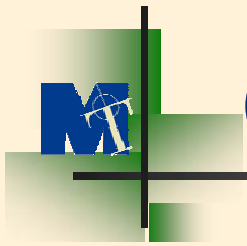
MS4 = Municipal Separate Storm Sewer System

WLA = Waste Load Allocation = permitted bacteria sources

LA = Load Allocation = non-permitted bacteria sources

MOS = Margin of Safety

TMDL = Average Annual Total Maximum Daily Load



Pagan River and Jones Creek Fecal Coliform TMDL

Impairment	WLA	LA	MOS	TMDL
Pagan River and Jones Creek	2.15E+12	8.09E+13	Implicit	8.31E+13
Isle of Wight MS4	1.31E+12			
VAR040020				
VA0088072	3.47E+09			
Future Load	8.31E+11			

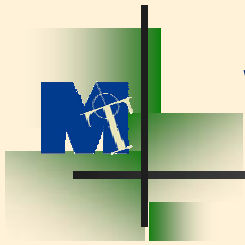
MS4 = Municipal Separate Storm Sewer System

WLA = Waste Load Allocation = permitted bacteria sources

LA = Load Allocation = non-permitted bacteria sources

MOS = Margin of Safety

TMDL = Average Annual Total Maximum Daily Load



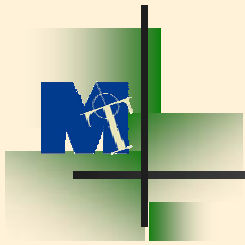
Where Do We Go From Here?

- TMDL Public Review (30 days)
 - Send comments to Jennifer Howell by June 11th
- State Approval of TMDL document
- Submit TMDL to Environmental Protection Agency
- Submit TMDL to VA State Water Control Board
- Implementation Plan
- Implementation



What Can You Do To Help?

- Become Involved
 - Be a part of the Implementation Plan Development
- Pick up Pet Waste
 - At parks and in your own yard
 - Ask local governments to install doggy stations with bags and trash cans in parks and along trails
- Maintain Your Septic System
 - Pump-out every 3 to 5 years
 - Inspect your yard to make sure it's not leaking
- Educate
 - Let your friends and neighbors know there is a bacteria problem and what they can do to help



Warwick River TMDL Contacts

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Questions?

Thank You:

- Department of Environmental Quality
- Department of Conservation and Recreation
- Hampton Roads Planning District Commission
- Peanut Soil and Water Conservation District
- Isle of Wight County
- Watershed stakeholders



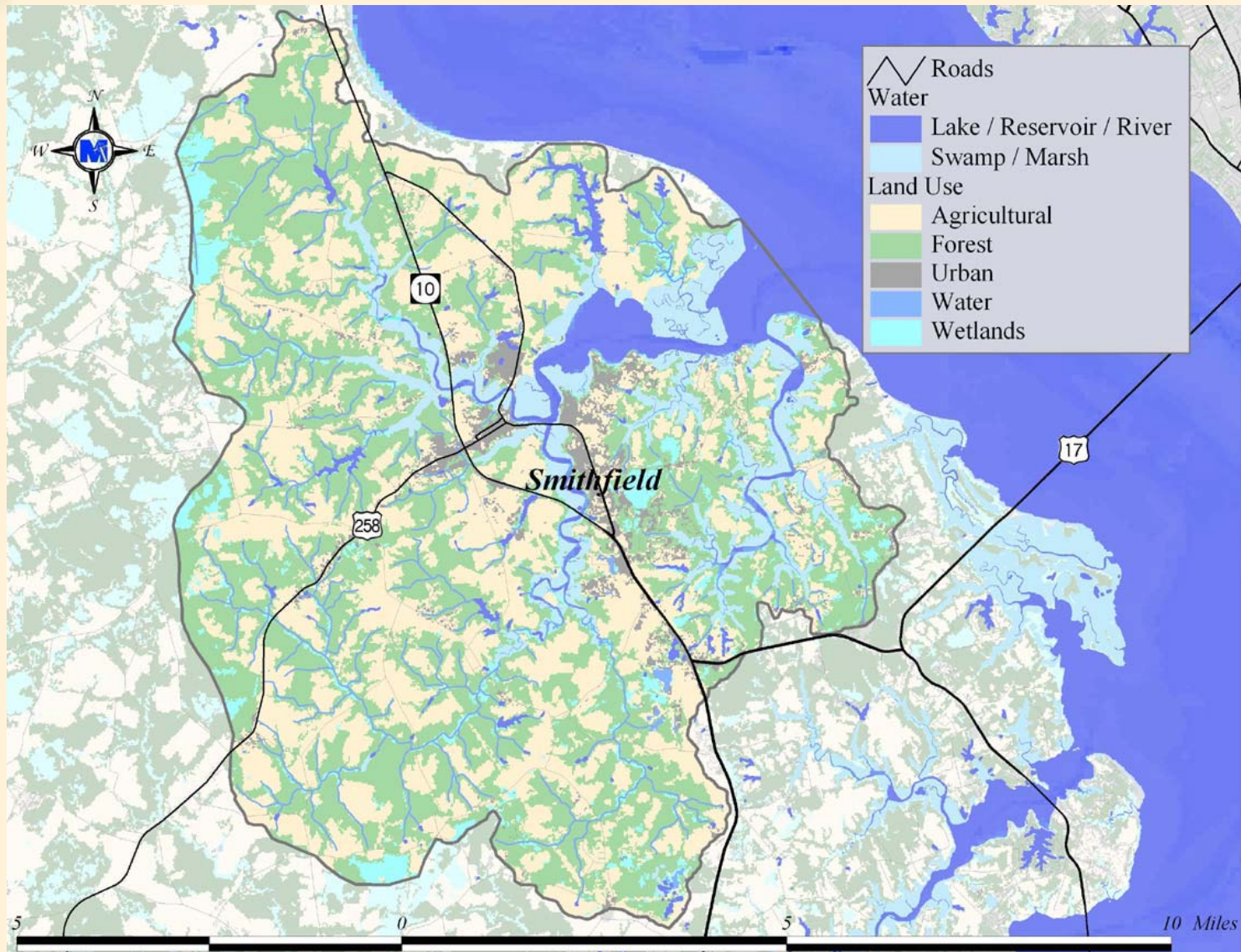
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Extra Information from 1st Public Meeting



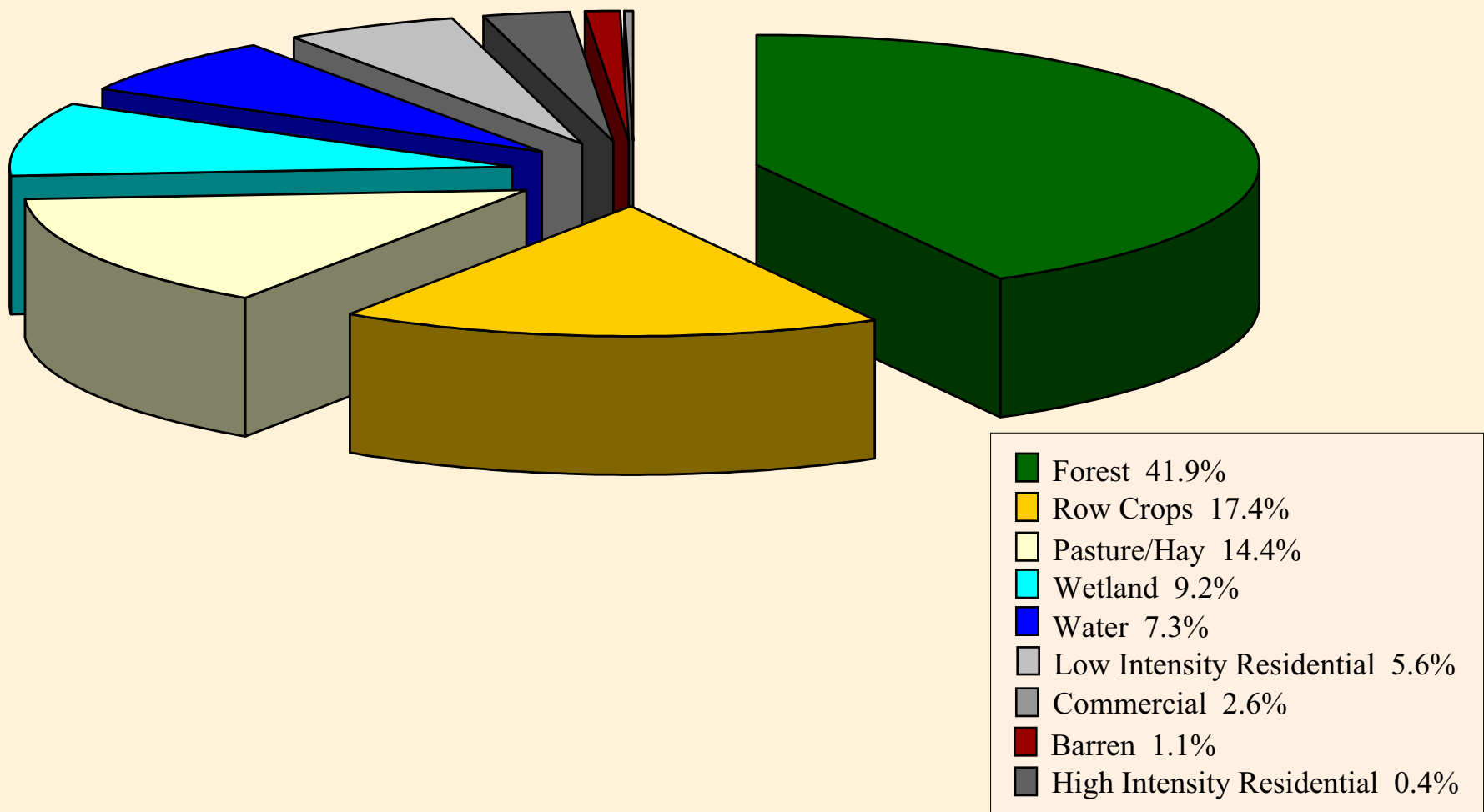
Land Use



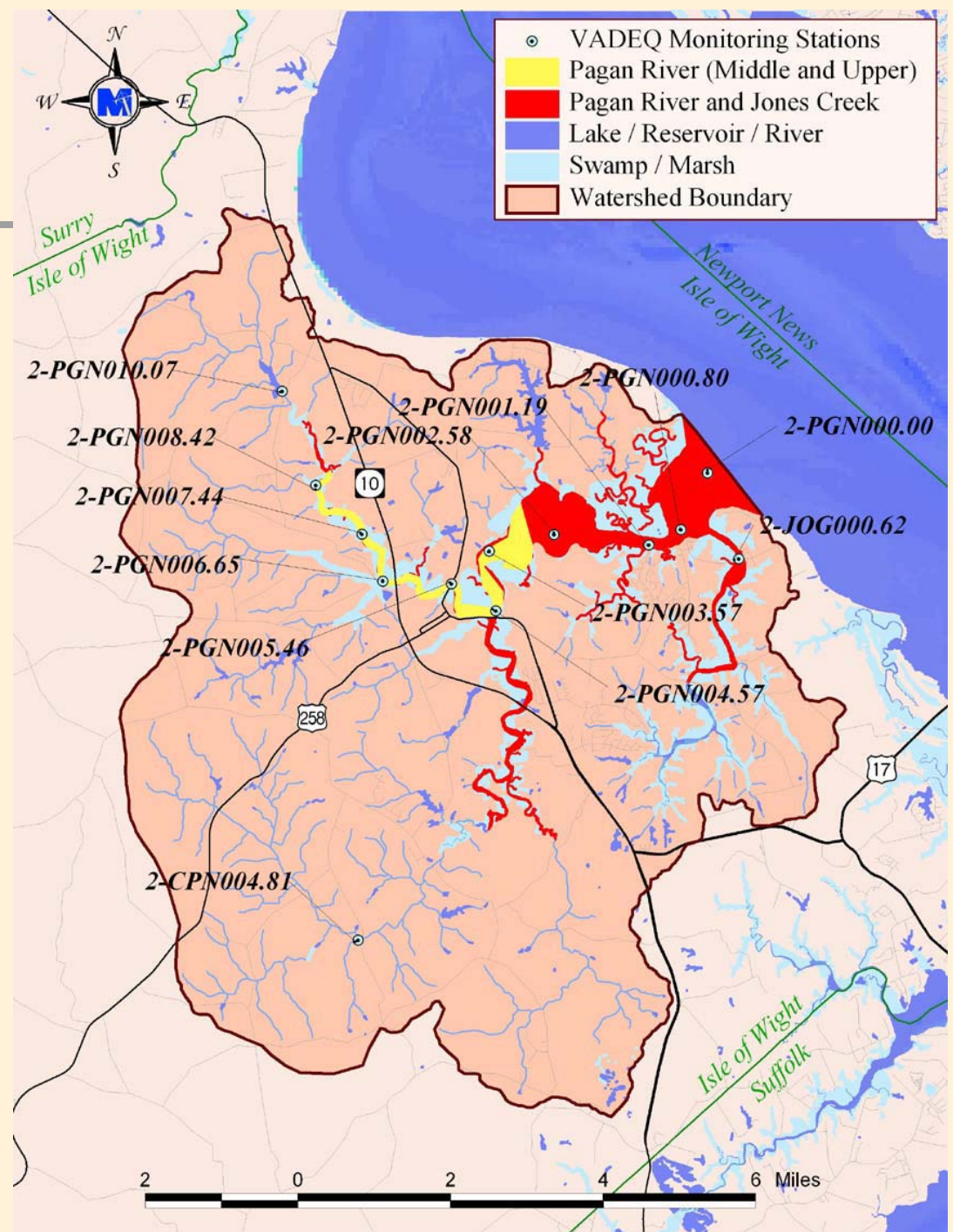


Land Use Percentage

Total watershed area is about 46,420 acres



VADEQ Monitoring



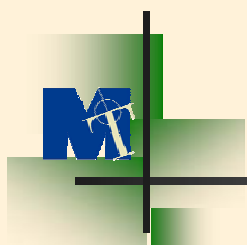


VADEQ Fecal Coliform Data

January 1980 through November 2005

Stream	Station	Count (#)	Minimum (cfu/100mL)	Maximum (cfu/100mL)	Mean (cfu/100mL)	Standard Deviation	# above 400 cfu/100mL	Violation ¹ (%)
Champion Swamp	2-CPN004.81	9	50	500	185	159	1	11%
Jones Creek	2-JOG000.62	126	2	2,400	98	273	6	5%
Pagan River	2-PGN000.00	117	2	1,600	46	156	2	2%
Pagan River	2-PGN000.80	127	2	2,400	104	300	4	3%
Pagan River	2-PGN001.19	129	2	7,000	142	651	8	6%
Pagan River	2-PGN002.58	126	2	1,600	149	300	10	8%
Pagan River	2-PGN003.57	123	2	24,000	520	2,203	26	21%
Pagan River	2-PGN004.57	123	2	11,000	531	1,168	34	28%
Pagan River	2-PGN005.46	138	5	71,600	1,516	6,731	53	38%
Pagan River	2-PGN006.65	124	2	24,000	812	2,369	49	40%
Pagan River	2-PGN007.44	122	4	24,000	893	3,052	48	39%
Pagan River	2-PGN008.42	125	2	24,000	1,160	3,682	50	40%
Pagan River	2-PGN010.07	264	2	9,200	405	837	55	21%

¹*Violations are based on the current fecal coliform instantaneous standard (400 cfu/100mL)*

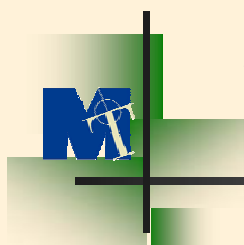


VADEQ *E. coli* Data

July 2002 through October 2004

Station	Stream	Count (#)	Minimum (cfu/100mL)	Maximum (cfu/100mL)	Mean (cfu/100mL)	Standard Deviation	# above 235 cfu/100mL	Violation ¹ (%)
Champion Swamp	2-CPN004.81	3	50	210	113	85	0	0%
Jones Creek	2-JOG000.62	10	10	100	30	31	0	0%
Pagan River	2-PGN000.00	10	10	20	12	4	0	0%
Pagan River	2-PGN000.80	10	10	80	23	23	0	0%
Pagan River	2-PGN001.19	10	10	30	15	8	0	0%
Pagan River	2-PGN002.58	10	10	30	15	8	0	0%
Pagan River	2-PGN003.57	10	10	70	33	23	0	0%
Pagan River	2-PGN004.57	10	10	90	44	30	0	0%
Pagan River	2-PGN005.46	10	10	80	35	24	0	0%
Pagan River	2-PGN006.65	10	20	280	85	78	1	10%
Pagan River	2-PGN007.44	10	10	140	73	39	0	0%
Pagan River	2-PGN008.42	10	10	250	78	66	1	10%
Pagan River	2-PGN010.07	20	10	2,000	210	452	2	10%

¹*Violations are based on the current *E. coli* instantaneous standard (235 cfu/100mL)*



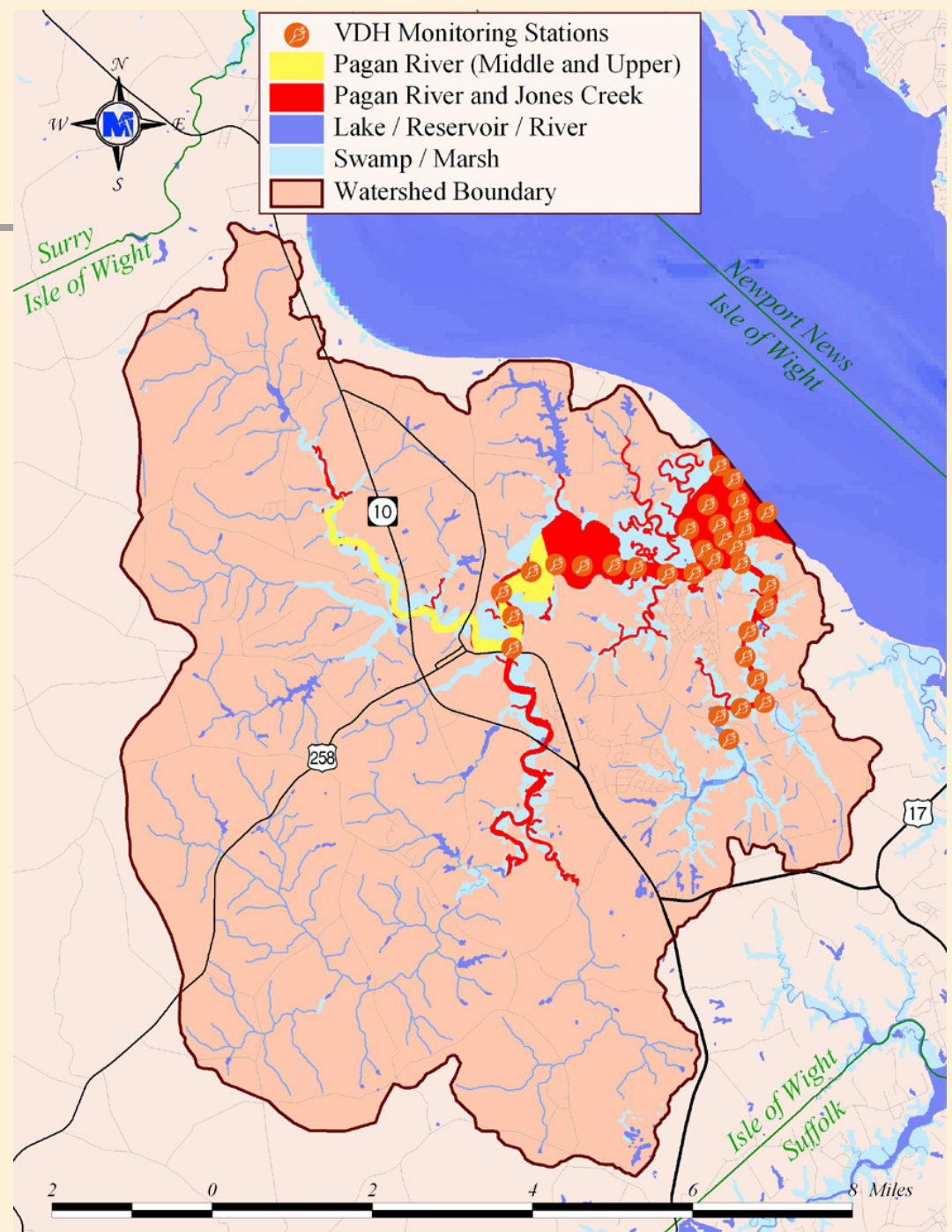
VADEQ *Enterococci* Data

March 2000 through December 2005

Stream	Station	Count (#)	Minimum (cfu/100mL)	Maximum (cfu/100mL)	Mean (cfu/100mL)	Median (cfu/100mL)	Standard Deviation	# above 104 MPN	Violation ¹ (%)
Champion Swamp	2-CPN004.81	No data	No data	No data	No data	No data	No data	No data	No data
Jones Creek	2-JOG000.62	21	10	320	46	25	75	2	10%
Pagan River	2-PGN000.00	21	10	100	26	25	23	0	0%
Pagan River	2-PGN000.80	21	10	170	38	25	35	1	5%
Pagan River	2-PGN001.19	21	10	160	37	25	43	2	10%
Pagan River	2-PGN002.58	21	10	120	37	25	32	2	10%
Pagan River	2-PGN003.57	21	10	180	52	25	55	5	24%
Pagan River	2-PGN004.57	21	10	180	52	25	49	4	19%
Pagan River	2-PGN005.46	21	10	380	74	40	86	4	19%
Pagan River	2-PGN006.65	21	10	600	138	50	176	7	33%
Pagan River	2-PGN007.44	21	10	1,200	128	30	256	7	33%
Pagan River	2-PGN008.42	21	10	1,700	227	80	417	8	38%
Pagan River	2-PGN010.07	6	10	800	247	130	307	3	50%

¹*Violations are based on the current enterococci 90th percentile standard (104 MPN)*

VDH Monitoring



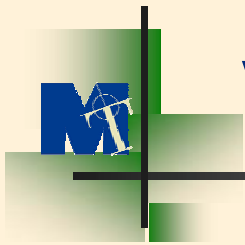


VDH Fecal Coliform Data

Station	Stream	Count (#)	Minimum (cfu/100mL)	Maximum (cfu/100mL)	Mean (cfu/100mL)	Median (cfu/100mL)	Geomean Violation ¹ %	90 th Percentile ² Violation%
61--0.5Z	Pagan River	239	2.9	1,200	31.5	9.1	0	55
61-1	Pagan River	159	2.9	240	11.9	3.6	0	0
61-1A	Pagan River	168	2.9	1,100	25	3.6	0	0
61-1B	Pagan River	158	2.9	1,200	38.3	7.3	0	24
61-1Y	Pagan River	169	2.9	1,200	54	9.1	6	86
61-1Z	Pagan River	212	2.9	240	16.5	3.6	0	6
61-2	Pagan River	175	2.9	1,200	52.9	11	71	74
61-2A	Pagan River	216	2.9	1,200	31.2	9.1	3	42
61-2B	Pagan River	174	2.9	1,200	51.8	9.1	30	65
61-2Z	Pagan River	175	2.9	1,100	66.7	15	57	71
61-3	Pagan River	175	2.9	1,200	56.3	23	76	88
61-3A	Pagan River	170	2.9	1,200	35.5	15	36	36
61-3B	Beatty Creek outlet	170	2.9	1,200	83	15	64	86
61-4	Pagan River	174	2.9	1,100	67.4	23	100	100
61-5	Pagan River	174	2.9	1,100	55.5	23	86	96
61-6	Pagan River	152	2.9	1,200	74.4	23	74	78
61-7	Pagan River	159	2.9	1,200	87.5	23	99	100
61-8	Pagan River	152	2.9	1,200	113.9	39	94	91
61-9	Pagan River	174	2.9	1,200	141.3	43	100	100
61-10	Pagan River	152	2.9	1,200	155.2	43	100	99
61-11	Pagan River	159	2.9	1,200	195.6	43	100	100
61-12	Pagan River	152	2.9	1,200	260.6	93	100	100
61-13	Pagan River	174	2.9	1,200	252.1	93	100	100

¹Violations are based on the current fecal coliform geometric mean standard (14 MPN)

²Violations are based on the current fecal coliform 90th percentile standard (49 MPN)



VDH Fecal Coliform Data (cont.)

Station	Stream	Count (#)	Minimum (cfu/100mL)	Maximum (cfu/100mL)	Mean (cfu/100mL)	Median (cfu/100mL)	Geomean Violation ¹ %	90 th Percentile ² Violation%
61-14	Jones Creek outlet	174	2.9	1,200	96.7	23	89	88
61-15	Jones Creek	174	2.9	1,200	93.1	23	100	100
61-16	Jones Creek	172	2.9	1,200	94.2	23	86	94
61-17	Jones Creek	151	2.9	1,200	115.1	43	100	93
61-18	Jones Creek	151	2.9	1,200	117.7	43	100	94
61-19	Jones Creek	150	2.9	1,200	134.2	43	100	93
61-20	Jones Creek	151	2.9	1,200	162.1	43	100	100
61-21	Jones Creek	151	2.9	1,200	155.5	43	100	100
61-22	Jones Creek	151	2.9	1,200	157.5	43	100	100
61-23	Jones Creek	150	2.9	1,200	142.7	43	100	100

¹Violations are based on the current fecal coliform geometric mean standard (14 MPN)

²Violations are based on the current fecal coliform 90th percentile standard (49 MPN)



2006 Human Population Estimates

Population	Number	Housing Units			
		With Sewer	With Septic	With Failing Septic	With Other (Straight Pipe)
15,900	6,368	2,502	3,812	623	54





2006 Pet Population Estimates

- Population/household based on literature values
 - 0.534 dogs per house
 - 0.598 cats per house
- Translated to HU based on U.S. Census
- Land-applied

Dogs	Cats
3,400	3,808





2006 Livestock Population Estimates

Beef	Beef Calf	All Dairy	Horse	Sheep	Chickens	Hogs
411	318	0	290	4	0	16,661





Wildlife Population Estimates

- Population based on data provided by VDGIF biologists
- Distribution of waste based on habitat
 - Land-applied
 - Direct deposition to the stream
- Seasonal variations based on migration patterns and food sources

Beaver	Deer	Duck	Goose	Muskrat	Raccoon	Turkey
1,424	1,207	438	172	19,746	1,077	346

